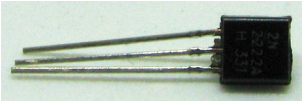
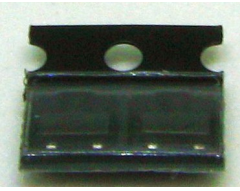
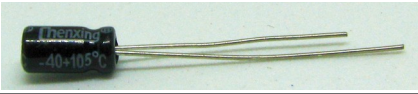
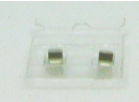
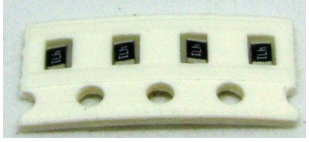
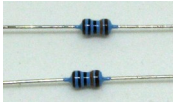
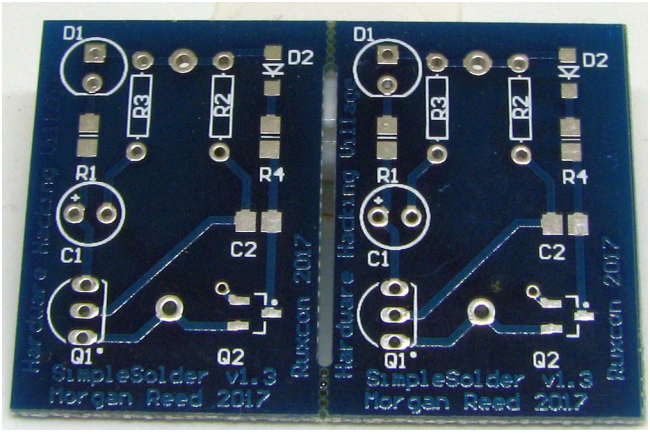
Ruxcon Hardware Hacking Village 2017

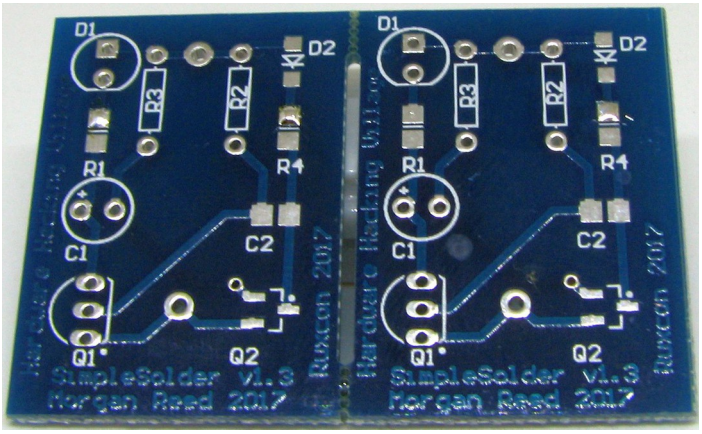
SimpleSolder instruction sheet

Bill of materials (note that there are two sets of parts in each kit);

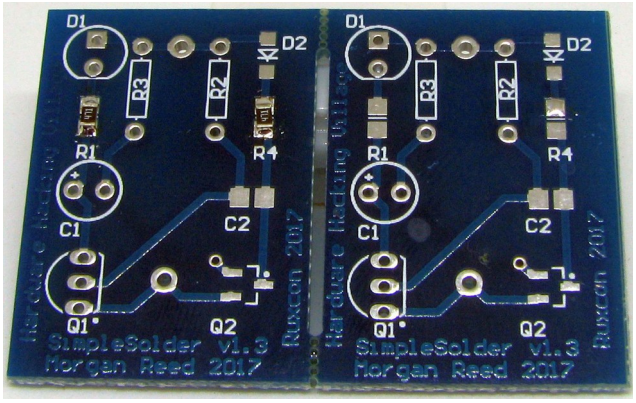
Qty	Description	Designators	Image
1	PN2222 TO-92 NPN Transistor	Q1	
1	MMBT2222 SOT-23 NPN Transistor (SMD)	Q2	
1	10uF Aluminium Electrolytic Capacitor	C2	
1	10uF MLC 0805 (2012 metric) Capacitor (SMD)	C1	
1	Red 5mm LED	D1	
1	Green 0805 (2012 metric) LED (SMD)	D2	
2	470R 0805 (2012 metric) Resistor (SMD)	R1, R4	
2	100k 1/8W Metal Film Resistor	R2, R3	
1	CR2032 Battery Holder	B1	



1. Each board is actually two boards. This guide only goes through populating the left hand board. The intention being that you can go through and build the left hand board at the conference and populate the right hand board yourself later (the boards can be snapped down the middle).



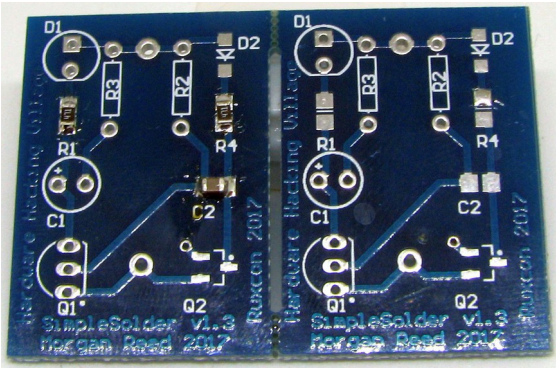
2.First we're going to solder the two surface mount resistors R1 and R4. The easiest way to do this manually is to “tin” one of the pads which basically entails applying a small amount of solder to the pad. (It's easiest to use fine solder for surface mount and thicker solder for through-hole parts) In the above image the topmost pads of R1 and R4 have been “tinned”.



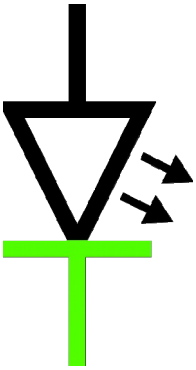
3. Next, place the resistors, positioning them so that one end is sitting on the tinned pad. Hold them in place with tweezers, then touch your soldering iron to the pad and the end of the resistor. The solder should flow onto the end of the resistor. Hold it in place for a moment while the solder freezes. After you've soldered the “tinned” end, apply solder to the other end of the resistor. Just a little dab will be enough; the end result should look similar to the above image.

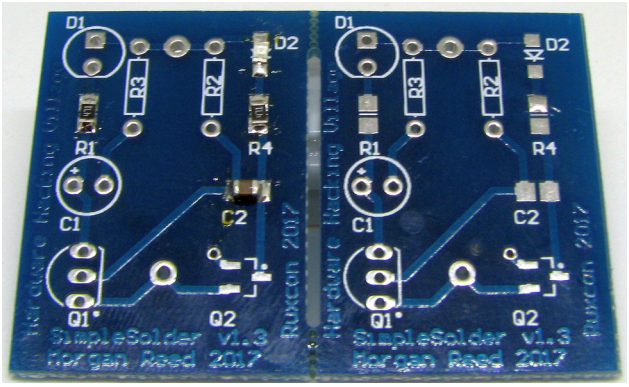
If you don't hold it down while the solder freezes on the first joint, it's liable to “tombstone” (basically the surface tension of the pool of solder causes it to stand up on-end). If this happens to you, you can just re-heat the pad and use your tweezers to push the resistor flat to the board.

If you plan to do more of this sort of thing in future, this is probably as good a time as any to learn about component “dressing”. It's not as clear from the above image as it could be, but if you look closely, you'll see that the resistors have a marking 471 on them, and that marking is oriented such that it can be read in the same orientation which allows you to read the vertical text on the board. It's just a bit neater and can be a help for troubleshooting and such down the track.



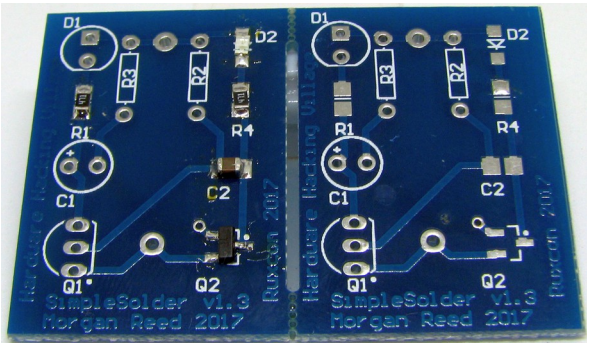
4. Repeat the process for the surface mount capacitor C2. Tin the pad, place the cap, hold it down while you touch the joint with your iron, then solder the other end.

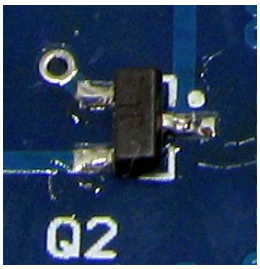




5. Next, we're going to mount the surface mount LED. It is important that you get the LED around the right way (if you don't the board won't work), if you look at the BACK of the LED you'll see it has a “T” shaped green mark on it. This corresponds to the marking on the PCB, the “stem” of the “T” should be pointing down.

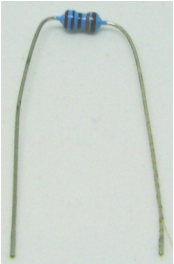
You'll have to be a bit careful with the placement on this one, although the footprint on the board is a standard 0805 LED footprint it still seems to have its pads spacing a bit excessively wide, so the LED will sit more “between” the pads than on them. A bit of extra solder here will help bridge the gap.

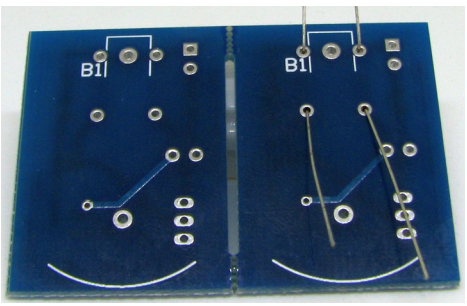


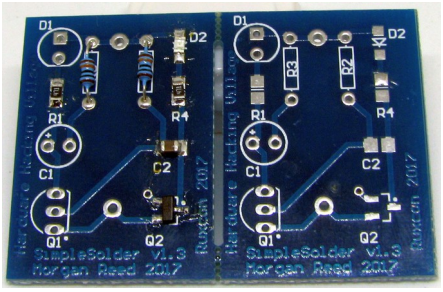


6. Last of the surface mount components is the transistor, this follows largely the same pattern as the others, I suggest soldering the single pad on the right first, because that will allow you to pivot the transistor a bit if you don't get it quite aligned with the other pads.

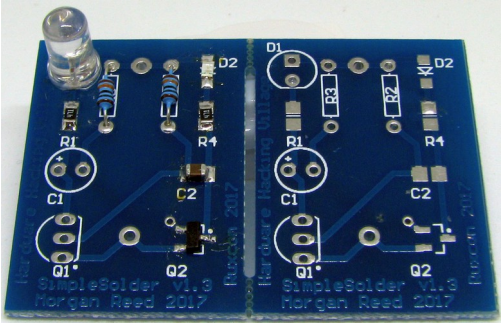
That concludes the surface mount parts, now for the easy bits ;)





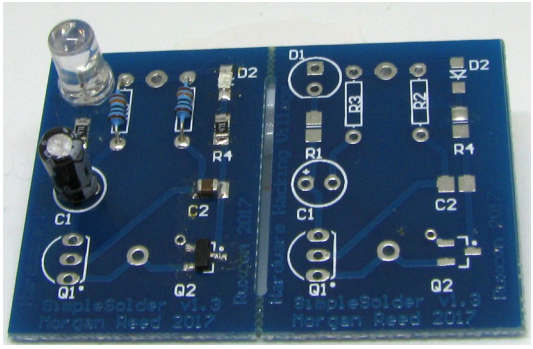


6. Grab two of your resistors and bend the leads at 90 degrees a few millimeters away from the body (left hand photo above), then insert them into the footprints on the board (R2 and R3). Once again, notice that they are installed such that they read (brown black black orange brown 100k 1%) the same way as the other components in this orientation on the board. Then flip the board over and solder the connections. Finally trim the leads off close to the board.



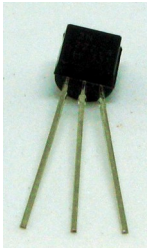
7. Next we're going to mount the through-hole LED.

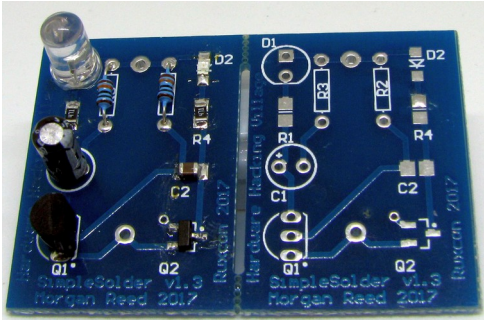
The LED is polarity sensitive (i.e. you need to put it around the right way). The easiest way to tell is by the leads on the LED, they're different lengths; the shorter one goes in the hole nearest the “flat” on the PCB overlay (there is also a VERY subtle flat on that side of the LED but it's hard to see). As you push it in you will eventually encounter resistance when the LED is about 5mm from the surface of the board, apply a bit more pressure and it'll “snap” through, at which point you flip the board over and solder it.



8. Next up is the through-hole capacitor, this one is also polarity sensitive, there's a “stripe” on the can which indicates the negative lead (No idea why, but for some reason it seems to be standard practise to indicate the positive on PCB overlays and the negative on the can of electrolytic caps).

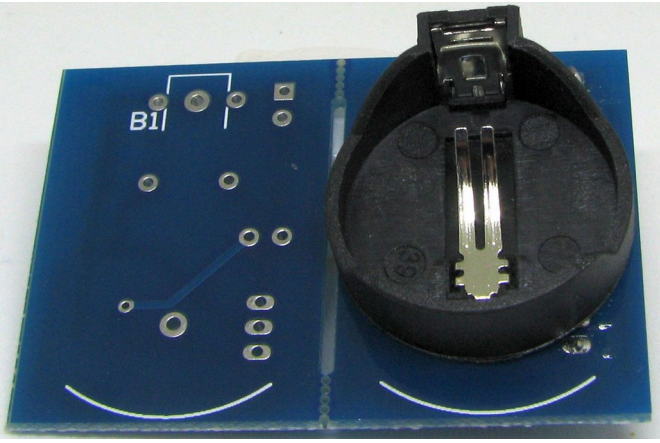
The stripe on the can should be facing “inwards” as shown in the photo above.





9. Next install the transistor.

It's easier to get this one into the board if you splay the leads a bit before insertion (see above), match the curved side of the transistor to the curve on the PCB overlay, i.e. the “flat” should face inwards. Insert the legs and push the transistor down snug to the board, flip it over and solder.

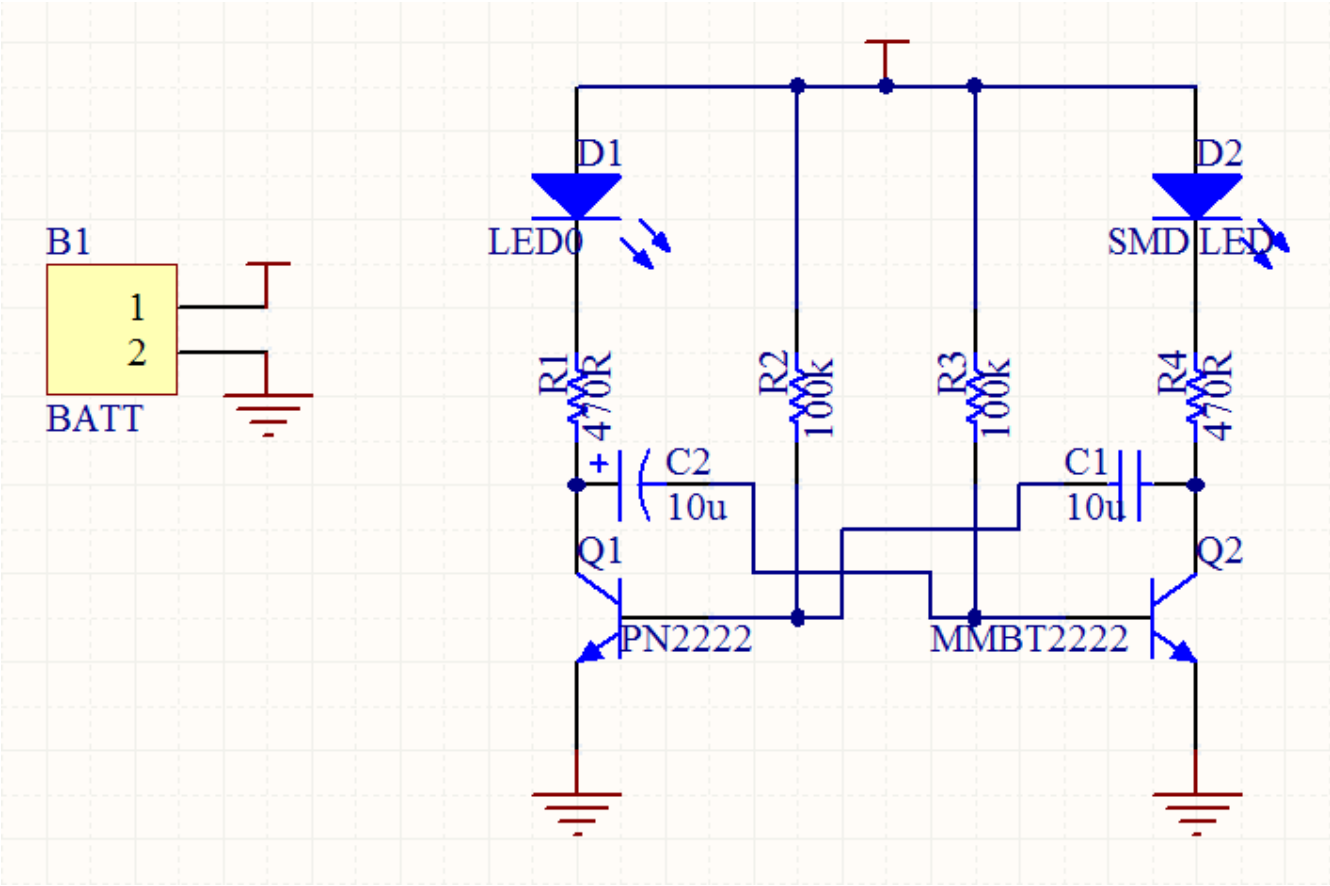


10. Last but not least we have the battery holder, this mounts on the opposite side of the board from everything else, flip your board over and insert it as shown above, the “curved” end goes towards the curve on the PCB overlay. Then flip it back and solder the two connections.

Be a bit careful with this one, unfortunately the supplier who we bought our battery holders from last year couldn't get enough in for our requirements so we had to go with the eBay special above. They work, but the bottom contact (negative) will come adrift at the drop of a hat. Once it's soldered in place you'll be fine though.

Now install a battery, and if all's well you should have the LED's alternating back and forth.

If this has whet your appetite and you think you're ready for something a bit more challenging, have a chat with the HHV staff about the Ruxcon 2017 Hardware Hacking Village badge. It's a more advanced and potentially useful project.



Troubleshooting

- The most likely cause of failure in this one is that you've put the SMD LED in back-to-front, to test this take one of your wire off cuts and bridge the connections on that LED, if the through-hole LED starts flashing then that's your problem.

- It is also possibile that you've not quite made a connection somewhere along the line, inspect your solder joints to see if you can see any gaps, and touch up any that look dodgy.

- Failing the above, come talk to one of the HHV staff and we'll see if we can figure out what's wrong.